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MAY 1986

FOR MANAGERS OF MANUFACTURING TECHNOLOGY

What Makes the Best Plants Go

GM's Orion, Wentzville, Hamtramck, and Wilmington Plants

Chrysler's Sterling Heights and Windsor Assembly
Ford's Chicago Assembly

Fiat's Termoli
Ford's Scorpio

Mazda's Hofu

PRODUCTION

MAY 1986 COVER-TO-COVER VOL. 97 NO. 5

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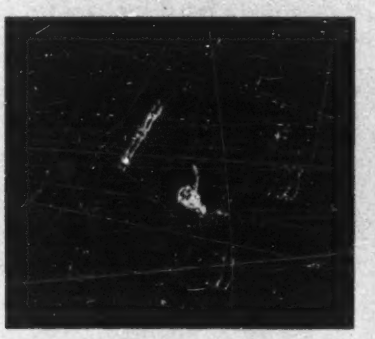

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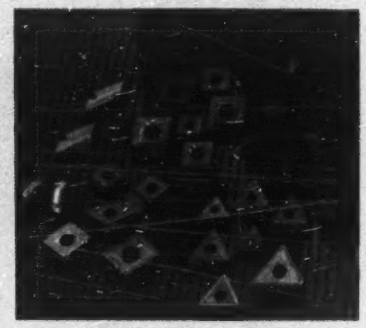

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FEATURES

WHAT MAKES THE BEST PLANTS GO: INSIDE WORLD AUTO MANUFACTURING

Automobile manufacturers are spending billions of dollars revving up their engines in the race for automobile supremacy in the 21st century. Equipped with lasers, robots, vision, and other advanced systems, world automobile manufacturers are utilizing the most advanced technology mankind has to offer. PRODUCTION Magazine looks at the best plants...and what makes them go.

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show, with leading sponsors, and a wider variety of technical seminars, SMTS-87 will attract a maximum of top-quality visitors with buying interest and authority, the NMTBA said.

Regional shows like SMTS-87 will reach beyond the bounds of present local shows. Instead of catering just to "drive-in" visitors, SMTS-87 will be promoted to every manufacturer and their key engineers and manufacturing staff within an hour's plane flight of Charlotte. This area encompasses a third of the American population and as much of the manufacturing and metalworking industry as the equivalent areas surrounding Boston or Los Angeles.

Exhibit space is being assigned now. For more information contact: Mr. Elwood Hasemann, Exhibition Director, National Machine Tool Builders' Association.

–Eastern region reported by Tom Halligan/Philadelphia

WASHINGTON

Reagan Mulling NMTBA Petition For Quotas

President Reagan is considering the National Machine Tool Builders' Association's (NMTBA) three-year-old petition for protection from foreign imports of machine tools.

The NMTBA petition seeks five years of import quotas on machine tools stemming from a national security clause—section 232, of the 1962 Trade Expansion Act.

However, there is strong indication from the White House that the President will deny the NMTBA petition for strict quotas, but in turn will try to negotiate a restraint agreement with Japan.

The NMTBA is particularly concerned with imports of Japanese machine tools that could hinder the readiness of the U.S. military in time of conflict.

Machine Tool Orders Continue to Climb

New orders for machine tools in February surged to $211 million, up 10.7 pct over January's figures, according to statistics compiled by the National Machine Tool Builders' Association (NMTBA).

However, measured against a year ago, February's total net new orders were off 11.1 pct., continuing the decline of new orders which have fallen for the eighth consecutive month compared to the same period the year before.

Metal cutting machine tools increased 25.0 pct in February, up from $135 million to $168.8 million. Conversely, new orders for metal forming machine tools declined 24.1 pct to $42.3 million from January's $55.8 million figure.

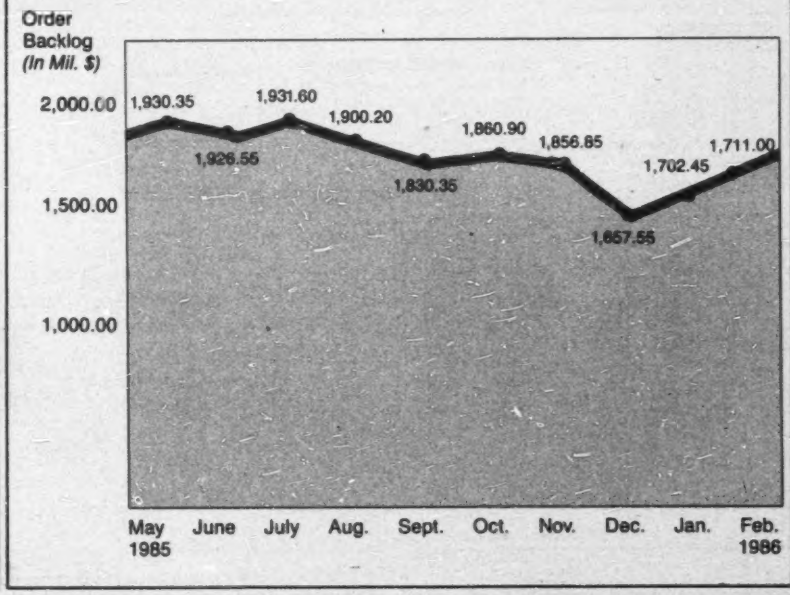
"We are seeing an increase in shipments, which certainly helps cash flow, but still no turnaround in net new orders," commented James Gray, president, NMTBA. "The manufacturing industries are caught in the middle as Congress and the President debate the various tax proposals. Up to a point, we are optimistic about the future as American industry moves to modernize and improve its competitive position," he added.

Total machine tool shipments for February stood at $202.6 million, up 38.9 pct over January, and a healthy 21.8 pct increase over February 1985.

February's metal cutting shipments totalled $124 million, up 35 pct over January. At $78.6 million, metal forming shipments increased 44.6 pct from January's totals.

The industry's order backlog rose to $1,711 million in February, up slightly from $1,702 in January.

MACHINE TOOL ORDERS
Backlog



MAP- What It Means To You

While the standard has been set, its implementation must now take place. Scores of vendors are developing MAP-compatible products which will make this growing phenomenon a part of your manufacturing operation in the near future.

By Sandra Brooks
Midwest Regional Editor

THE MANUFACTURING AUTOMATION Protocol (MAP), General Motors' demand to standardize communications methodology so that its more than 40,000 intelligent devices scattered across 14 plants can intercommunicate, has emerged as the de facto standard.

However, it is important to distinguish between MAP, the document and MAP, the tangible product. Today, the product does not exist.

The MAP document, Version 2.1, is comprised of a selection of available communications standard protocols and GM specifications covering topics for which no standards exist. The effort was initiated in April 1980 by a GM task force, drawing from the work of five organizations, including the International Standards Organization (ISO), the American National Standards Institute (ANSI), the Computer and Business Equipment Manufacturers Organization (CBEMA), the Institute of Electrical and Electronic Engineers (IEEE) and the National Bureau of Standards (NBS).

By June of 1982, GM had formally adopted MAP as a communications standard and requested that suppliers follow the MAP specification for interconnection. The political turmoil among vendors who vied to protect their proprietary communications protocols (and gain market share) by becoming sole vendor to GM was fueled when GM organized the first MAP Users Group meeting in March 1984 at McDonnell Douglas in St. Louis.

That single action propelled GM's effort into the public domain.

In the two years since, membership in the MAP Users Group has grown to include 800 companies and individual members. Throughout the world, complementary organizations, including the Canadian, European and newly-organized Japanese and Australian MAP Users Group organizations, continue to drive the MAP effort with their interest and support.

The development of MAP however hinges upon the *process* of needs evaluation, commercialization of technological solutions and trial-and-error use.

Just what MAP ultimately will be remains to be seen. Version 2.1, released in March 1985 will be supplanted by V.3.0 early in 1987—V.2.2, primarily the addition of a carrier-band specification, will be released late in 1986.

Upward compatibility of V.2.1 to V.2.2 is inherent to the enhanced specification. However, migration from V.2."x" to V.3."x" will require considerable software modification and, possibly, the use of gateway-like hardware.

Before you suck in your breath as you prepare to approach your financial officer for additional MAP funds to achieve this migration, remember that a tangible MAP does not exist. If you are among the increasing number of network users, yours is, at best, MAP-*compatible*, not MAP-*compliant*. Therefore, routers, bridges, gateways and software translators already reside somewhere on the network. The worst case scenario is that users will need to write a few lines of a new code.

Sorting It Out

Countless documentation addressing MAP—has been published over the past two years. ISO/OSI, 802."x", x."y", RS"n", ISA, CCITT, HDLC, NIU, TIM, MMFS, FTAM, EPA; all permeate the alpha-numeric computer soup through which potential users must wade—the important question is: What Do You Do With It?

Specifications, protocols and standards are critical elements to the development and universal implementation of technology. But, they are not the technology. They are not the implementation, and they are not the solution.

MAP is not an entity unto itself—rather, it is an integral part of the global CIM concept.

GM has a very real need for computers, robots, programmable controllers and other automation-related equipment.

The Japanese have had an impact on GM's decision to implement MAP. GM realized that in order to effectively

compete with Japan it needed to improve quality and the cost to the consumer. From the production perspective this implies a dramatic reduction in scrap and rework, significantly lower material inventory and productivity increases. This means that there is the ability to quickly change existing line production from one product to another, rather than continually building additional lines to accommodate new products and the capability to increase demand while other plants operate below capacity.

The reality of MAP is that it is another automation tool. A very powerful tool, but its order of magnitude will be directly proportional to understanding the tool and its implementation.

MAP is not a panacea for manufacturing ills. It will be incumbent upon the user to identify the proper location of an intelligent device, assess its function, determine what information needs to be collected, identify where that information needs to go, specify what will be done with the information when it arrives. In order to accomplish this, users must analyze their entire operations—not only the shop floor—but the *functional* interrelationships of all departments from the boardroom to the toolroom, from plant to plant, down through the supplier network. MAP will not do that job for you.

What it will do, however, is to put the resources you need to drive an effective, responsive and competitive organization easily within reach.

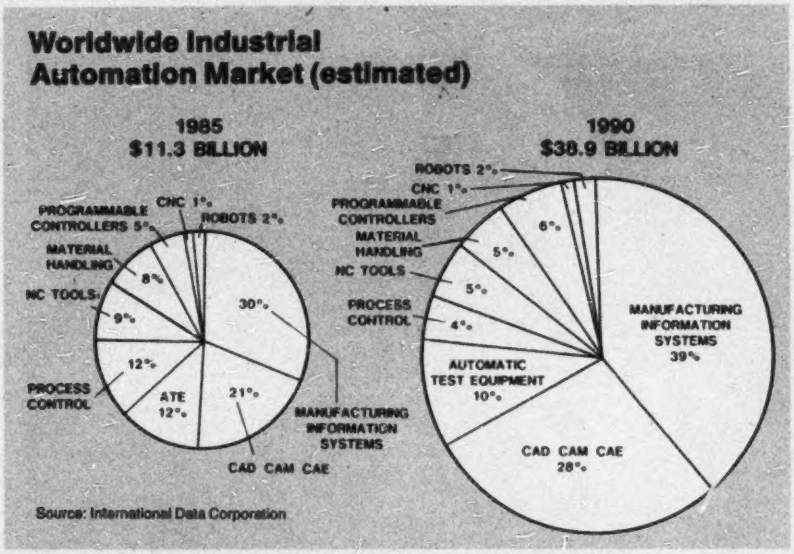
The Users

Beside the flurry of activity to develop MAP, to a completed, accepted world-wide compilation of standards rests a handful of pioneers who are leading the way with the implementation of available products. Currently no implementation of the MAP specification V.2.1 exists. However, the number of MAP-compatible proprietary broadband network continues to grow and increase in its function.

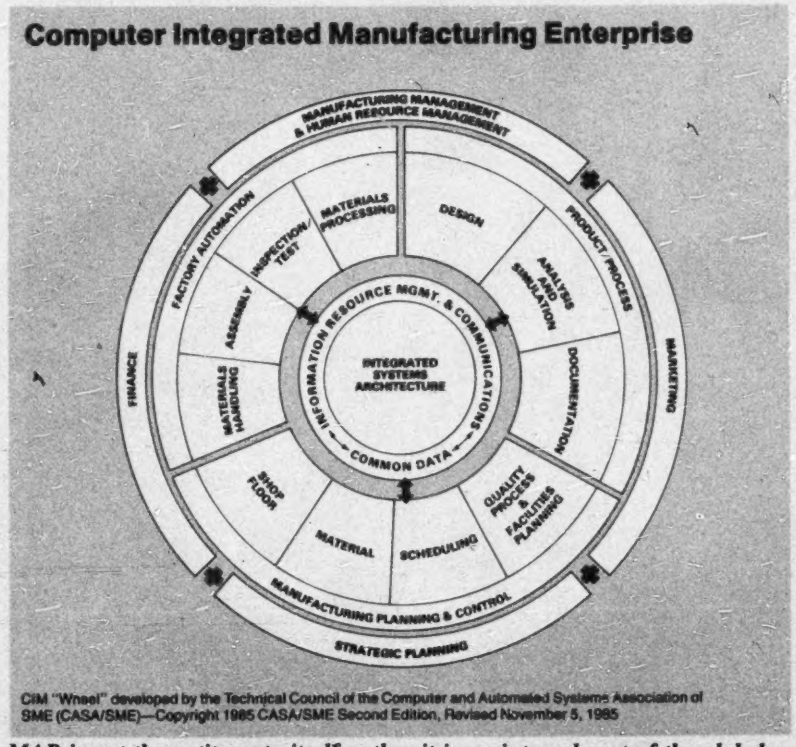
At GM, a network of implementation compatible with MAP V.2.0 have been completed at the B-O-C plant in Ham-

GM'S MAP Program Is Expected To Have A Far-Reaching Impact

Illustration by Tom Barrett



The worldwide automation market (above) is estimated to be $38.9 billion by 1990 as shown in the chart. As the implementation of MAP technology continues to grow, the elements of automation equipment market will be affected including producers of robots, CNC equipment, programmable controllers, material handling devices, numerical control tools, process control equipment, MIS, CAD/CAM and CAE and automatic testing equipment. Vendors of this type of equipment will be impacted by its continuing use in the manufacturing environment.



MAP is not the entity unto itself–rather it is an integral part of the global CIM concept.

tramck, Mich., and at the C-P-C plant in Bowling Green, Ky., according to Mark Cocroft, advanced product and manufacturing engineering staff, GM Tech Center.

Two major networking projects are slated for this year; one at Saginaw Div. (Factory of the Future) which will run through 70,000 sq. ft. of the facility and would integrate machining, robots, assembly and automated guided vehicles (AGVs). The other, known as GMT 400, would encompass five truck plants—metal stamping operations at Indianapolis, Ind. and Flint, Mich. and assembly operations at Oshawa, Ont., Pontiac, Mich. and Ft. Wayne, Ind.

Indianapolis and Flint have no commitment to run MAP. The reasons are simple; the equipment does not support MAP and the implementation of gateways rather than using cell controllers would increase network costs by at least $3-million, explained Marnie Lerums, of EDS.

In April 1985, Kaiser Aluminum began installing its MAP-compatible proprietary network at its Erie, Pa., forging plant. More than 150 different pieces of equipment, and an energy management system, have been integrated on the largest Concord Data network in the U.S., according to Bill Geibel, staff research engineer responsible for the implementation.

It was put into operation in July 1985. "It immediately gave us the ability to look at the whole plant (17 buildings on 26 acres) as a single, continuous process," said Mr. Geibel.

The critical part of the network is a detailed specification and integration plan, according to Mr. Geibel. "We learned each operation, we analyzed how communications were being transacted, we made sure we'd never need to rewire and we planned for the worst," said Mr. Geibel.

Installation problems were minimal —although there were some instances of bad connections and a need to insulate the equipment from extreme temperatures.

"While we can't show an increase in revenue due to the network until the end

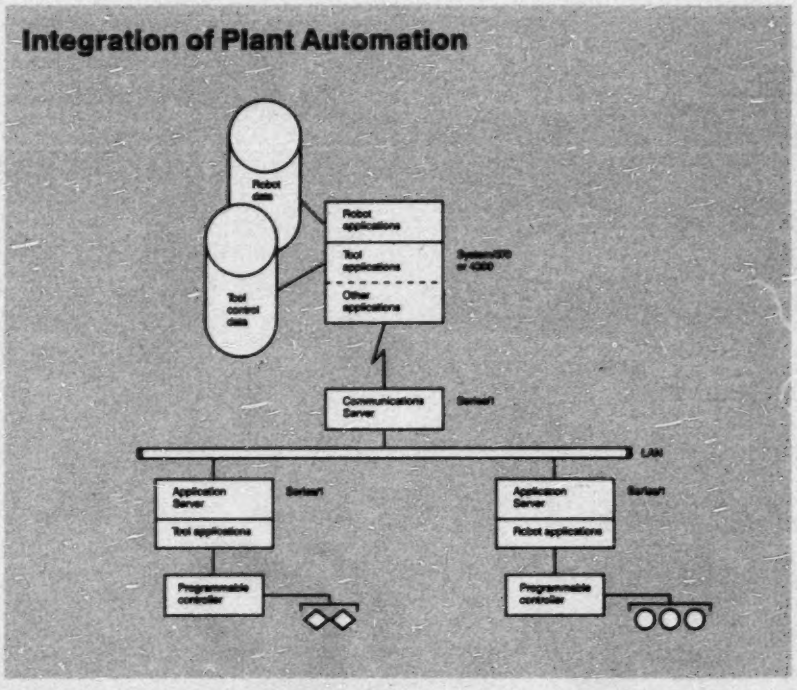
of the fiscal year, we know we're cutting costs," Mr. Geibel stated. "Initially we monitored peak power usage. One of the things we monitor is electrical usage. We discovered that peak demand occurs after lunch break. By rescheduling the work force, we're saving $8,000 per day without changing the operation. That alone will payback the cost of installation within 12-18 months," said Mr. Geibel.

Deere & Co. has earned several distinctions in the networking arena. In 1981 the first Computer and Automated Systems Association (CASA) awarded the Lead Award to the Tractor Works in Waterloo, Iowa; in February 1985 the first production implementation of a MAP-compatible network at the Farm Combine factory, East Moline, Ill.; and its current effort is the installation of a MAP-compatible proprietary network (Allen-Bradley Data Highway) at the 2.8 million sq. ft. plant in Des Moines, Iowa.

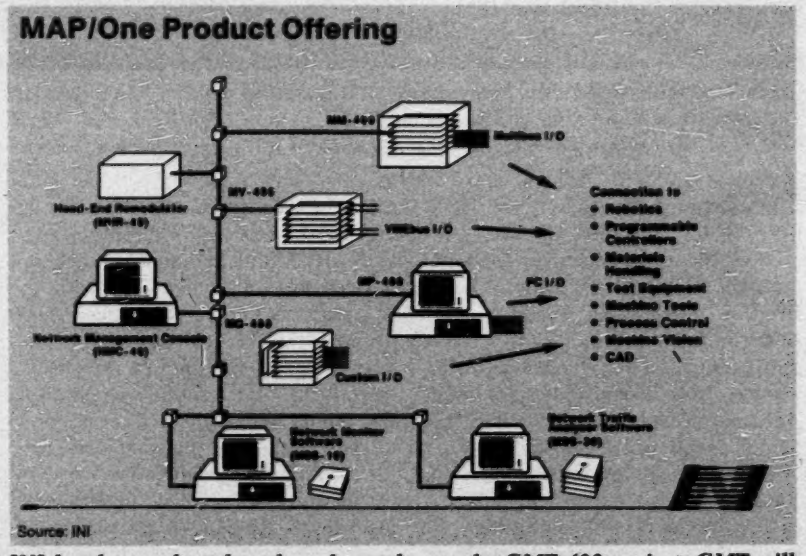
The initial Des Moines network implementation will focus on three cells—turret punch press, tubing and robotics—which will be phased into production over the next 6 to 12 months. Driven by an existing DNC control and the need for increased security, the multi-media broadband network ultimately is intended to support video, voice, fire detection, card access/gate controllers, coordinate measuring machines (CMMs), personal computers, graphic engineering workstations and programmable controllers. The network also will feature a mini-MAP (EPA) carrier-band subnet for real-time control.

Deere has invested well over $1-million in its networking efforts. According to Dave Scott, division manager Computer-aided Manufacturing Services, Moline, Ill., "justification has been based on R&D."

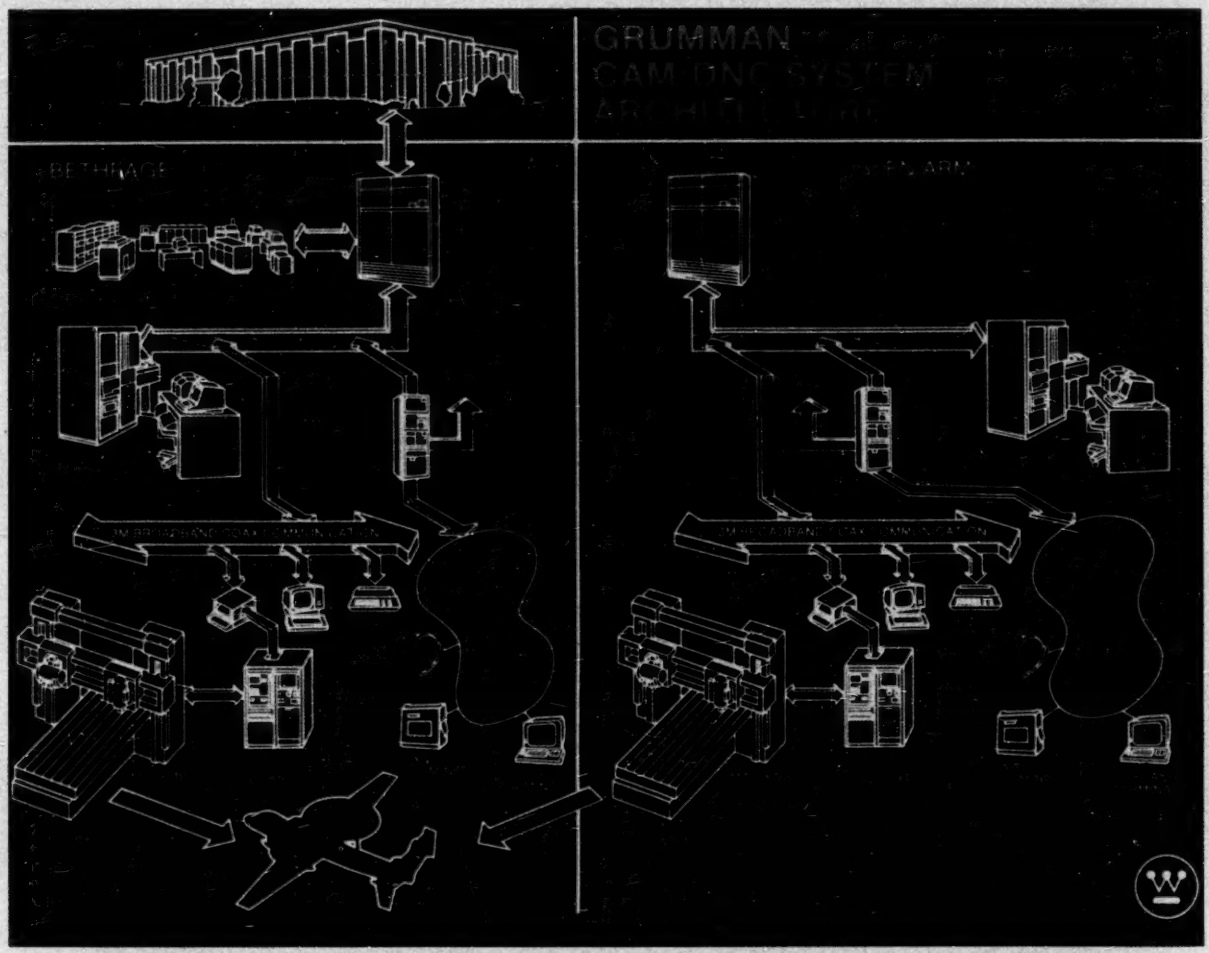
"By approaching MAP with the utility philosophy to build a plant-wide communications infrastructure, we gain experience. We don't have any quantitative results yet, but we have everything to gain and nothing to loose," Mr. Scott said.



IBM's new series/1 MAP Application Server and series/1 MAP Communications server programs support the integration of plant floor automation equipment into a single network. They allow information to be shared with a variety of automation devices, including plant floor computers, programmable controllers and robotic systems from different manufacturers. The plant host computer also can receive information about the status of work being done.



INI has been selected as the sole vendor on the GMT 400 project. GMT will integragated millions of lines of code between hundreds of devices interfaced over 10 miles of cable. The magnitude of this contract and the number of diverse development agreements between INI and other vendors has the potential to commercialize an "almost-MAP-byproduct".



Grumman Aerospace Corp. Bethpage N.Y. is installing its first MAP compatible proprietary broadband network. The network will integrate two facilities, Bethpage and Glen Arm, Md., via PBX with the host computer residing in Bethpage. More than 78 machining devices, 100 CRT's and peripheral devices will reside on the network.

Grumman Aerospace Corp, Bethpage, N.Y. is installing its first MAP-compatible proprietary broad-band network (3M/LAN1, sold to Allen Bradley late 1985). Westinghouse Electric Corp., Pittsburgh, Pa., is prime contractor and "total systems integrator with responsibility for hardware and software," according to Stan Serota, project manager. The network is scheduled for production by mid-1986.

This network will integrate two facilities, Bethpage and Glen Arm, Md., via PBX, with the host computer residing in Bethpage. Each facility has installed complete duplicate or "mirror" systems, from mainframe to cable, "for security reasons," Mr. Serota explained. More than 78 machining devices, 100 CRT's and sundry peripheral devices will reside on the network.

Equipment costs have reached "tens of millions of dollars," said Mr. Serota, "but we predict return-on-investment (ROI) within two years." The ability to quickly turn around prototypes, flexibility in small-lot manufacture, guaranteed consistency in production and ease of modification are just a few of the benefits that Grumman expects to translate into reduced manufacturing costs.

IBM Corp. has chosen its Endicott, N.Y. facility as the site of its first MAP implementation. Still in the early design phase, the network will be used to monitor process, rather than assembly, operations. It is scheduled to be operational in 1987.

Vendors

Twenty-one vendors participated in the MAP demonstration jointly sponsored by GM and Boeing during AUTOFACT'85. They were: Advanced Computer Communications, Allen-Bradley, ACDS, ASEA, AT&T, Charles River Data Systems, Computervision, Concord Data Systems, Digital Equipment Corp., Gould, Hewlett-Packard, Honeywell, Industrial Networking Inc. (INI), Intel, Intergraph, IBM, Motorola, NCR, Northern Tele-

At Kaiser Aluminum a MAP compatible proprietary network was installed at the company's forging plant. More than 150 pieces of equipment, and an energy management system have been integrated into the plant's operations.

com, Siemens and Sun Microsystems.

The testbed demonstration was a success. It also, demonstrated the weaknesses of the MAP specification. The (AUTOFACT) demonstration forced the ambiguities, and the differences in interpretation," said Hewlett-Packard's Paul Accompo, MAP product manager. "Now that vendors have reached a level of conformance, they will be able to work on products," he explained.

But only to a point. The MAP specification is not yet stable, nor is it complete. "Vendors are in a ticklish situation. Each must be the first to market without investing huge amounts for temporary implementations," explained Deere's Dave Scott.

At Honeywell "we hesitate to distribute AUTOFACT software—it's not yet product. The upper-layer FTAM spec was still in a draft form at the time. It was unclear and subject to interpretation. There is a major effort underway to correct the MAP 2.1 errata which may appear in V.2.2 or V.3.0. As a result, true MAP 2.1 product probably won't be available till summer 1986," according to Greg Morris, manager MAP program and Jeff Marks, consulting engineer, Phoenix, Ariz.

The result is a classic "Catch-22". Potential users have little to implement, vendors have a limited data from which to build new, or enhanced, product.

MAP is at a critical point in its evolution. GM's task is further development of the specification. Clearly, it is not responsible, nor in the position, to make the specification work. That task falls to the vendors. Yet the vendors still must contend with a moving target while sustaining criticism for offering proprietary solutions.

By the January 1986 MAP Users Group Meeting in Toronto, more than 260 vendors had expressed intent to support the MAP specification. Joint development agreements between and among vendors are being announced almost daily.

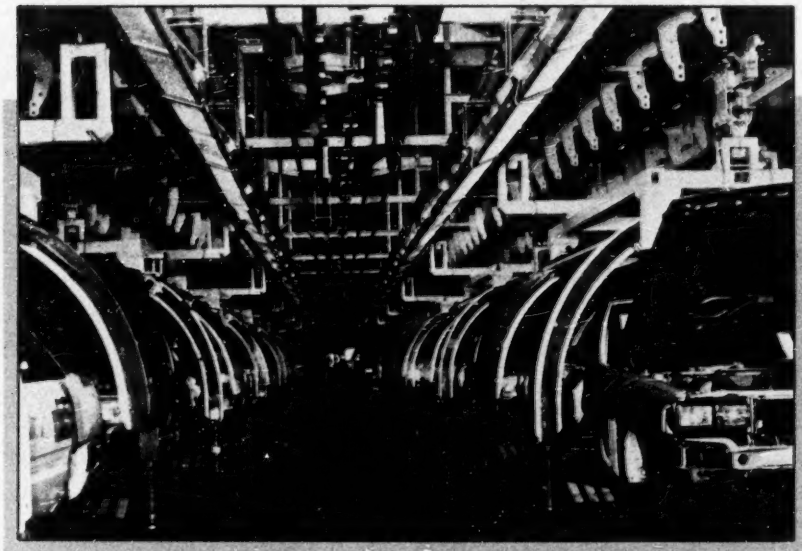
"It's in everybody's interest to have MAP work," said Tony Helies, president of Concord Data Systems, "not demonstrating interoperability is stupid."

But if the MAP effort is to continue its momentum, it's time to make it real. At the SAE Congress and Exposition, February 1986, a morning technical session devoted to MAP was attended by fewer than 25 persons. Show attendance was in excess of 30,000.

"Today, there are other things that will accomplish the same thing," said Kevin Hughes, MAP director at Allen-Bradley, Highland Heights, Ohio. "They may have their drawbacks and limitations, but companies are able to make product."

This year must see actual implementation, of a concerted effort of MAP-complaint equipment. "The market is divided between the early adopters and GM. The future market is dependent upon the results of 1986, the stability of the technology, in order to avoid the proliferation of a single communication solution," said Leonard Magnuson, marketing manager OEM communications, Intel.

There is concern among vendors *and* users that situation may be redeveloping. INI has been selected by GM as the sole vendor on its GMT 400 project. With the MAP document V.2.1 not yet finalized, and with no means of assuring consistent interpretation and implementation, the magnitude of this contract and the number of diverse development agreements between INI and other vendors has the



The concept of MAP is not only being applied and implemented in the U.S. Other companies and countries are moving ahead with how the technology can fit into the European manufacturing landscape. One company, Siemens of West Germany has joined the list growing of MAP vendors. Siemens, like other companies in Europe is interested in the impact of MAP will have on its programmable controller business. In this photo programmable controllers are used to monitor each stage of car body assembly.

Need to Understand MAP? Here's Who Can Help

Support is available from a growing number of suppliers. Ship Star Associates, Newark, Del., offers a series of seminars which cover topics such as business aspects, status and products, OSI concepts, protocols and standards, specifications and futures, implementation issues and network management. Robert Crowder, president of Ship Star, is the founding vice-chairman for standards and chairman for control standards of the MAP Users Group and chairman of the ISA Proway and IEEE 802 fiber optic token bus committees. He is also involved with the ANSI upper layer OSI committee and the NBS/OSI implementors workshop.

Integrated Automation offers support with the management task of integrating the factory. Contact Glen Yeager in Pontiac, Mich.

The Society of Manufacturing Engineers, which was appointed secretariat of the MAP Users Group, offers a variety of support material through the MAP User Group of the SME. Contact Mark Shaw, Dearborn Mich. for membership details and specifics on MAP support services.

GM intends to develop an implementation guide after completion of the Saginaw and GMT 400 projects for internal use, according to Mike Kaminski. It may migrate to the public domain.

EDS will be available to transfer its expertise after the technology is implemented at GM on a consultancy basis, according to Mark Cocroft.

In Canada, support is offered by the Canadian MAP Interest Group (CMIG). Contact the secretariat, the Canadian Standards Association in Rexdale, Ontario.

In Europe, Siemens is spearheading a drive to integrate manufacturing with a worldwide standard. The company is working with INI and the Fraunhoffer Institute in West Germany to develop a conformance testbed. The European Economic Community has created a new initiative under its ESPRIT program, known as Communication Network Manufacturing Applications (CNMA) in order to introduce MAP protocols within the European computer, automation and automotive industries. The Cranfield Institute of Technology, Bedforshire, England, has been named the European Map Users Group (EMUG) secretariat. At the CIM Center commissioned by IBM, R&D efforts and training programs are available to EMUG's 180 members. Texas Instruments is working with Cranfield on network and machine tool interface devices for universal machine connectivity.

For information on the Japanese and Australian MAP Users Group, contact the MAP Users Group secretariat, SME, in Dearborn, Mich.

Other Activities

The Technical and Office Protocol (TOP) is a specification document, also based on the OSI concept, initiated by Boeing for use in technical and office environments. Publicly released at AUTOFACT '85, it is completely MAP compatible, enabling information to move between office and factory environments. The basic difference is the implementation of baseband cable, which, according to Laurie Bride, manager networking technology at Boeing Computer Services, is specified because office environments typically don't require the attributes of broadband (distance, token passing). In March 1986 the MAP Users Group formally combined the efforts of the two groups into the MAP/TOP Users Group.

Over the past five years, the Air Force has developed its own approach to a communications solution, the Integrated Information Support System (I^2S^2). Working closely with GM and Boeing, I^2S^2 is fully MAP-compatible and will be supplanted by MAP protocols as they are stabilized. The Air Force Logistics Center is in the process of developing an official policy for use of MAP/TOP as part of its modernization program.

potential to commercialize in "almost-MAP-byproduct".

GMT 400 will integrate *millions* of lines of code between *hundreds* of devices interfaced over *10 miles* of cable, according to Joe Schoenebeck, president, INI.

Conformance

In 1984, the Network Evaluation and Test Center (NETC) was established at the Industrial Technology Institute (ITI), Ann Arbor, Mich., as an independant MAP test center.

Work there, and at the National Bureau of Standards, is feverishly underway to establish standard tests for functionality, interoperability and reliability. However, standard tests must evolve from a standard specification. That is a criteria which MAP cannot yet fulfill.

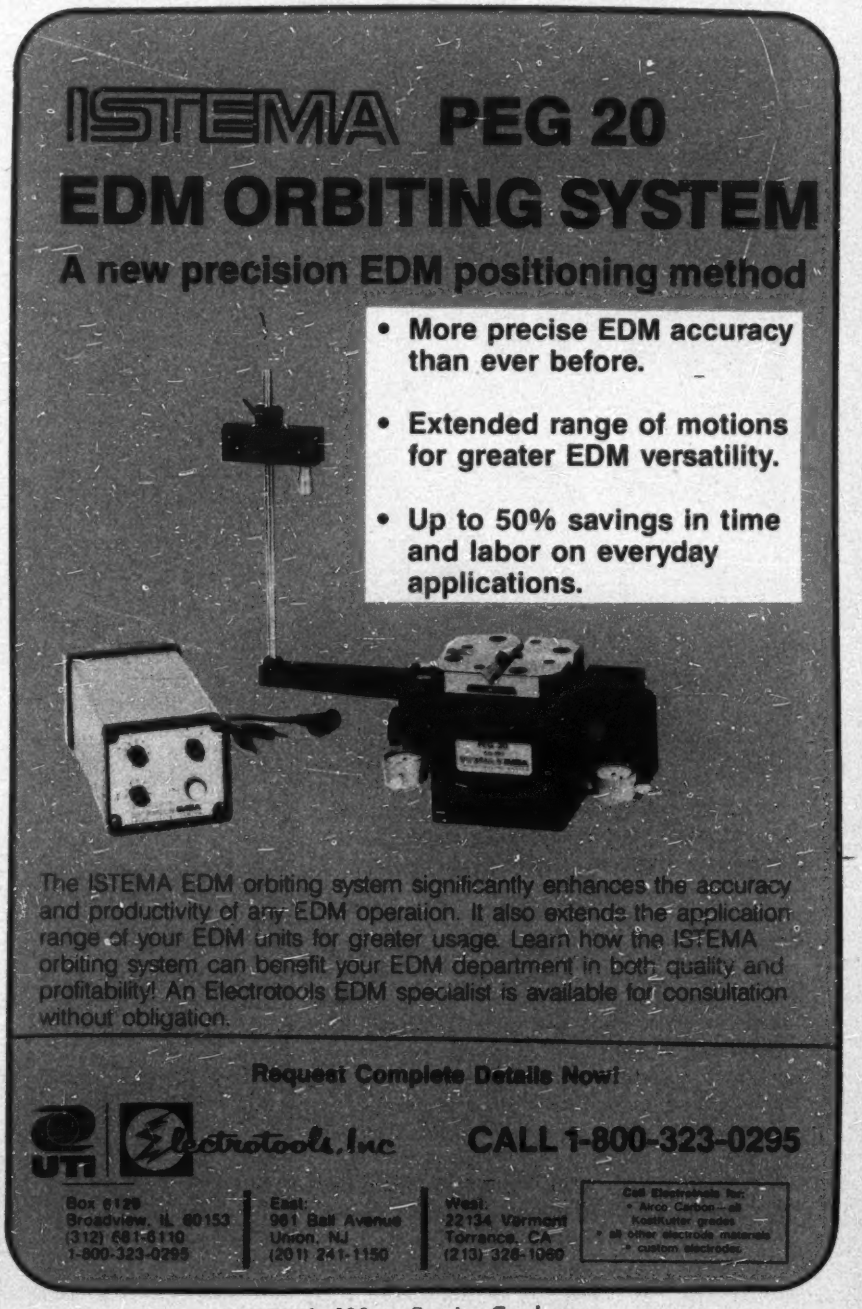
A number of vendors have "tested" interoperability. However, the best case testing is limited to the lower layers of the OSI model and only between two products at a time. In other words, if product 'A' can communicate with product 'B,' and if product 'B' can communicate with product 'C,' it *does not* follow that product A can communicate with product C.

A newly-formed non-profit organization, the Corporation for Open Systems (COS), Washington D.C., plans to develop test and certification methods, in addition to working for industry standards. Member companies include: AT&T, Bell Communications Research (BELCORG), Control Data Corp., Convergent Technologies, Digital Equipment Corp., Harris, Hewlett-Packard, Honeywell, IBM, Intel, NCR, National Semiconductor, Perkin-Elmer, Prime Computer, Sperry, Telex, Tandem, Wang and Xerox.

Will an actual "MAP" emerge? Undoubtedly. The magnitude of the new industry which that movement has generated guarantees the development of a communication solution. The net result, however, remains to be seen.

Nevertheless, the consensus among both vendors and users lies with the implementation of broadband networks. It's multi-media capabilities will support virtually anything.

Success will be a function of planning. Detail each aspect of what is it you hope to accomplish with a network, study the existing information flow, draw upon the implementation experience of documented users, and plan for requirements 10 years out. P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